☐ Conversion
☐ Update
☐ Informal Review
☒ Formal Review

STATE OF MONTANA
MONTANA DEPARTMENT OF TRANSPORTATION
JOB PROFILE AND EVALUATION

SECTION I - Identification

Working Title: Geotechnical Engineering Specialist
Class Code Number: 172537

Department: Transportation
Division & Bureau: Engineering/Materials

Class Code Title: Civil Engineer PE
Pay Band: 7

Section & Unit: Geotechnical
Work Address: 2701 Prospect Avenue
Helena, MT 59620

Position Number : 40033, 46004, 46017, 40055 & 40002

Phone: (406) 444-6332

☐ FLSA Exempt ☒ FLSA Non-Exempt

Profile done by: Richard B. Jackson

Work Phone: (406) 444-6281

Work Unit Mission Statement or Functional Description:

The Highways and Engineering Division prepares projects for bidding and coordinates highway construction. The division is made of the Materials, Construction, Right-of-Way, Bridge, and Preconstruction Bureaus; the CADD Systems and Engineering Management Support Sections; and five District Construction Offices in Missoula, Butte, Great Falls, Glendive, and Billings for budget and workforce purposes.

The Geotechnical Section prepares Geotechnical engineering for design, construction, and repair of the highway system and ancillary maintenance facilities through the performance of field, laboratory, and engineering investigations of soils and rock conditions. Investigation and analysis involves research and evaluation of geological setting, soil and rock strength parameters, slope stability characteristics, groundwater flow, foundation support of bridge and building structures, settlement magnitudes, modification of earth materials, and constructability. Work encompasses pre-construction, construction, and post-construction maintenance phases of the highway program and includes interaction with the public and outside consultants.

Describe the Job's Overall Purpose:

This position conducts professional geotechnical engineering analysis and design. The incumbent evaluates project plans; establishes guidelines, procedures, and parameters for various projects and activities; plans and oversees a variety of investigation, sampling, and engineering projects; provides advanced technical assistance to a variety of individuals and agencies involved with ongoing road construction projects; and performs a variety of other duties in support of the Department goals and Division objectives. The incumbent reports to one of the District Geotechnical Managers and to the Geotechnical Engineer.

SECTION II - Major Duties or Responsibilities

% of Time

1. Duties and Responsibilities

GEOTECHNICAL ENGINEERING ANALYSIS AND DESIGN 55%

This position provides advanced professional engineering analysis and final design service for geotechnical aspects of Department road and bridge construction projects. The geotechnical engineering specialist evaluates overall project purpose and requirements to determine geotechnical issues and impacts; establishes analytical procedures and conducts engineering analyses; designs alternatives and approached to complex geotechnical problems; organizes and writes comprehensive reports to present findings and recommendations; designs field exploration plans and directs subsurface investigations; reviews, modifies plans and analyses developed by other members of the Geotechnical Section, and attends and conducts reviews and conferences to discuss, coordinate, and develop solutions to geotechnical problems. This requires thorough knowledge of the concepts and theories of geotechnical engineering, geology, mathematics, the physical sciences, and highway and bridge design; methods and practices of highway construction and construction engineering; engineering policy; materials properties, specifications, and test methods; and construction safety practices. The position also requires considerable knowledge of traffic engineering; highway economic, safety, and efficiency issues; Engineering Division objectives and Material Bureau goals; project planning; research methods and techniques; highway construction methods and techniques; transportation planning, design, and highway construction processes; field applications of highway engineering and construction; environmental rules and regulations; and construction methods and practices. These duties also require advanced skill in reading and interpreting complex plans and contract documents, interpreting and writing specifications as well as the ability to use logical and understandable approaches to analyzing geotechnical projects; plan and manage numerous phases of multiple projects; interpret complex designs, plans, drawings, statutes, and regulations; apply analysis and judgment in arriving at solutions to difficult engineering research, and contract problems; exercise professional judgment to arrive at timely decisions in complex situations. This includes:

- Serves as a department expert in one or more specialized geotechnical engineering applications and is responsible for addressing the most complex professional issues associated with geotechnical engineering. The geotechnical engineering specialist is expected to show initiative in researching and proposing new methods and practices for statewide adoption, developing innovative approaches to design problems, and incorporating new standards and technologies into Department operations.

- Perform final designs for landslide repair, rockfall repair, and MSE retaining walls specifications, and help prepare the Engineer's Estimate. This duty requires a thorough knowledge of geotechnical design requirements and MDT policies. This knowledge must include not just the content of the requirements but the fundamental geotechnical behaviors or construction limitations behind the code provisions or policies so that when conflicts or ambiguity arises the Geotechnical Engineering Specialist has the ability to apply professional judgment in a reasonable and safe manner to resolve the issue. This duty also requires a basic knowledge of geotechnical earthquake engineering principles in order to perform the earthquake analysis and design. Due to the nature of geotechnical design, the judgments made are not a matter of correct or incorrect but more a matter of reasonableness and require a high level of knowledge of geotechnical engineering. The Geotechnical Engineering Specialist must have the ability to reasonably verify complex computer analysis based on simplified hand calculations, knowledge of geotechnical engineering, and professional judgment.

- Perform final geotechnical engineering, earthquake analysis for landslide repair, rockfall repair, bridge and wall foundation elements, and MSE retaining walls. Use professional judgment in selecting and choosing the analysis procedure. Do reasonable verification of the models through

simplified hand calculations. The earthquake design field is expanding and changing rapidly. The Geotechnical Engineering Specialist will occasionally deal with situations that are unprecedented in the State of Montana and may encounter situations for which there is no precedent nationally. Both of these situations will require collaboration with other Geotechnical Engineers and reliance on recent research in order to define the earthquake response and arrive at a reasonable solution.

- Evaluates overall project purpose and requirements to determine specific geotechnical issues requiring analysis; identifies actual and/or potential engineering conflicts, errors or deficiencies; and anticipates problems associated with individual projects and specific geotechnical considerations (e.g., bearing pressures, slope stability, groundwater flow, etc.).

- Establishes analytical procedures and conducts detailed engineering of geotechnical components of specific projects, including bearing pressures, short and log-term settlement magnitudes, cut and fill slope stability, foundation supports and pile foundations, groundwater and seepage flow, dynamic and seismic loading conditions, and other analytical procedures.

- Develops alternatives and innovative approaches to complex geotechnical problems (e.g., unexpected site or environmental conditions, design flaws, safety concerns, aesthetic problems, etc.). This involves advanced engineering design, research, and coordination among various department work units to identify and resolve engineering deficiencies.

- Organizes and writes comprehensive geotechnical reports to present results of field and laboratory studies, analytical procedures, and technically defensible recommendations for geotechnical design parameters. Recommendations typically include roadway alignments, slope inclinations, pavement support, rock fall and landslide mitigation and remediation, surface and subsurface drainage, foundation preparation and installation, liquefaction, and a variety of other complex site-specific factors. The incumbent must synthesize a multitude of scientific concepts, analytical results, and design standards and requirements into defensible recommendations to ensure the fundamental technical integrity and overall success of various projects. Develops preliminary cost estimates for preferred geotechnical recommendations and alternatives to provide accurate and complete projections for Division cost-benefit analyses.

- Writes special provisions for geotechnical aspects of construction such as pile driving, drilled shafts, retaining walls, slide repairs, MSE walls, etc.

- Designs field exploration plans to synthesize complex engineering factors related to topography, buried and overhead utilities, anticipated geological conditions, available and appropriate exploration equipment, and specific project requirements. Directs the installation and monitoring of instrumentation used in exploration borings and construction.

- Directs detailed engineering subsurface investigations to collect and analyze the various soils and rock samples according to project specifications. This involves modifying standards and procedures to develop site-specific sampling and analytical testing procedures, determining appropriate locations, and establishing other parameters (e.g., time frames, equipment, etc.) as necessary to ensure accurate results.

- Checks the analytical results generated by other members of the Geotechnical Section to verify the engineering and logical integrity of procedures and results. The incumbent identifies errors or deficiencies through review of reports and calculations.

- Attends and conducts reviews and conferences for specific project elements and special design considerations by contractors, departmental personnel, and other state and local agency

personnel as necessary. This involves providing expert advice on geotechnical engineering issues, resolving discrepancies and differing views, and attaining agreement on consensus on design solutions to geotechnical problems. Reviews, distributes, and documents decisions made at conferences.

PROJECT PLANNING, OVERSIGHT, AND CONSTRUCTION ASSISTANCE 25%

This position provides planning for Section projects to ensure the most efficient, cost-effective, and otherwise appropriate use of human and material resources. This includes establishing guidelines and parameters for site-specific geotechnical studies; conducting technical reviews of construction plans to verify appropriate incorporation of geotechnical considerations and recommendations; developing solutions to a broad range of engineering deficiencies and problems; designing and administering a Laboratory Testing Program; and providing on-site and remote geotechnical engineering advice and technical assistance to a variety of parties. This requires thorough knowledge of the concepts and theories of geotechnical engineering, geology, mathematics, the physical sciences, and highway and bridge design; methods and practices of highway construction and construction engineering; engineering policy; material properties, specifications, and test methods; and construction safety practices. The position also requires considerable knowledge of traffic engineering; highway economic, safety, and efficiency issues; Engineering Division objectives and Materials Bureau goals; project planning; research methods and techniques; highway construction methods and techniques; transportation planning, design, and highway construction processes; field applications of highway engineering and construction; environmental rules and regulations; and construction methods and practices. These duties also require the incumbent to apply skills in communication and negotiation; developing and administering a variety of diverse projects and functions; and developing ideas and solutions for complex problems. This includes:

- Plans and prioritizes Section projects to ensure the most efficient, cost-effective, and otherwise appropriate use of human and material resources within inflexible PMS timelines and parameters. This involves assessing past project requirements and outcomes, ongoing projects and priorities of the Bureau, and availability of resources to develop effective plans and appropriate priorities. The incumbent must frequently readjust plans to accommodate special circumstances (e.g., legislative impacts, errors, delays, etc.).

- Establishes guidelines and parameters for site-specific geotechnical studies to establish sample collection types, techniques and locations; analytical methods; human and material resource requirements; and other parameters. The incumbent must frequently adapt established guidelines and parameters according to variable site-specific conditions (e.g., unexpected environmental conditions, safety concerns, equipment limitations, etc.).

- Conducts technical review of Construction plans to verify appropriate interpretation of geotechnical recommendations and requirements through both office and field reviews. This involves examining engineering plans and specifications; performing advance project modeling work using engineering concepts and computer tools; and assessing applied construction methods to ensure that geotechnical recommendations and requirements are incorporated appropriately.

- Provides advice to Construction when problems arise in the field and visits sites as necessary. Designs solutions to a broad range of engineering deficiencies to facilitate timely project completions and ensure compliance with federal and state construction and contract requirements. This involves coordination with engineering and design professionals and the theoretical application and testing of engineering concepts to assess the feasibility of various alternatives.

- Designs and administers a Laboratory testing Program based on field investigations, analytical results, and scientific observations to manage and monitor testing assignments for soil and rock samples recovered from field investigations.

- Confers and advises other Section staff (e.g., laboratory technicians, etc.) in performing advanced and/or specialized geotechnical and geomechanical testing procedures to ensure the scientific integrity of procedures and results. Examines laboratory calculations and test results to verify the accuracy, relevance, and overall integrity of scientific procedures and conclusions. Oversees the preparation of summary report of results by laboratory technicians to ensure the accuracy completeness, and relevance of analyses and conclusions.

- Supervises responses to Emergency Relief Projects involving rockslides, landslides, and related road hazard emergency situations. The incumbent must determine the precise mature and severity of emergency situations; develop effective mitigation plans; and coordinate with District Engineers, Maintenance Chiefs, and supervisors to manage and mitigate specific emergency situations.

- Monitors operations to ensure compliance with the terms and conditions of individual contracts as well as applicable state and Department policies, procedures, laws, and other requirements.

- Provides on-site and remote geotechnical engineering advice and technical assistance to other state and federal agencies, Department staff, District Offices, county commissioners, individuals, contractors, and others regarding geotechnical considerations and requirements for specific projects.

CONSULTANT OVERVIEW 15%

Coordinates with consultants, reviews analytical results, methodologies, and recommendations from consultants to verify the scientific and logical integrity of procedures, results, and conclusions. The incumbent identifies and resolves errors or deficiencies through critical review of reports and documentation, site investigations, and personal consultations and negotiations. The analysis consists of three components: the Preliminary Engineering Evaluation review, the Geotechnical Survey and Reports review, and the Geotechnical Engineering Final review.

The Preliminary Engineering Evaluation review consists of the following Consultant activities: literature and map review; site visit to identify geology, slopes, roadway, drainage, wetland, and other geotechnical issues; and identification of potential Geotechnical problems.

The Geotechnical Survey and Reports review includes analyzing the Geotechnical engineering alignment and structures reports with recommendations. The following items are analyzed for the Field and Laboratory Data: exploration plan; boring logs in MDT format including soil and rock information; geophysical methods; groundwater elevations; structural geology mapping; and soil and rock laboratory testing results including moisture content, Plasticity Index, soil classes, consolidation testing, strength parameters, and etc. The following items are examined for the Geotechnical Engineering - Alignment: geological setting; identification of potential geotechnical problems; geotechnical calculations; settlement calculations; slope ratios; shrink/swell factors; recommendations for embankment foundation treatments, digouts, geotextiles, surface and subgrade drainage, culvert foundation preparation and bedding, structural foundations, retaining structures, pavement and Slab-on Grade; instrumentation and monitoring; and special provisions for materials and construction methods.

The Geotechnical Engineering - Final Review is a review of the engineering analysis, design, and report of the Earth Science environment resulting form changes to design after previous review of final reports.

In addition to the geotechnical aspects on Consultant designs, the incumbent is responsible for the Materials Bureau analyzing their reviews and making comments on Consultant designs in a timely fashion.

OTHER DUTIES AS ASSIGNED 5%

Performs a variety of other engineering, project management, and other activities assigned by the Geotechnical Engineer or the Geotechnical District Manager in support of the Department mission and Division objectives. This includes exchanging information with contractors, agency staff, and the public; providing professional and technical assistance; directing special projects' participating in state, interstate, and federal research programs; and attending ongoing education and training as needed.

2. Specific examples of problems solved, decisions made, or procedures followed when performing the most frequent duties of this position.

As the agency's geotechnical authority for a District and Department expert in one or more specialized geotechnical engineering applications, the position is expected to determine the nature and scope of the most complex geotechnical design problems; determine optimum methods, procedures, and tools for addressing site-specific and project sensitive issues; and develop and approve geotechnical designs for major construction projects. Problems may involve pile design, drilled shafts, slope stability, spread footings, rockfall, road subgrade, retaining walls, embankment stability and settlement, culvert foundations, seismic factors, and blasting; geological, a and related scientific features; new engineering standards and project requirements; and logistical issues (e.g., location, timelines, etc.).

This position is also responsible for researching, assessing and incorporating developmental methods, standards, and technologies into Department geotechnical engineering practices to promote the delivery of state-of-the-art geotechnical services for statewide projects. These considerations must be balanced with District priorities as well as statewide geotechnical operations.

Identify potential geotechnical problems early in the project design process and implement a plan to define the situation and provide an engineered solution in a timely fashion. Commit department resources to the project as needed.

Prioritizes District workload through the use of the project management system, knowledge of project specific requirements and input from other district project management personnel. Estimates project demands and projects short and long-term resource needs. Negotiates with other geotechnical engineers and the Geotechnical Engineering Specialist to determine allocation of internal resources and to determine the need for external resources e.g., consultant engineers, contract drilling, contract testing).

3. The most complicated aspect of this position is?

The most complicated aspect of the position involves assessment of specialized geotechnical engineering features and developing optimum methods, procedures, and tools for addressing site-specific and project sensitive issues. As a Department expert in one of more specialized geotechnical engineering applications, the position is responsible for addressing the most complex professional geotechnical engineering issues associated with geotechnical engineering. This includes researching and proposing new methods and practices for statewide adoption, developing innovative approaches to v design problems, and incorporating new standards and technologies into Department operations. The position must balance these considerations with individual and inter-District priorities and requirements.

4. Guidelines, manuals or written procedures support this position are?

Available geotechnical engineering laws, regulations, guidelines, manuals, and/or procedures include State, federal, AASHTO, and FHWA requirements and standards; project specifications; Montana Materials Manual, Construction Manual, Traffic Engineering Manual, Standard Specifications for Road and Bridge Construction, and a variety of other specialized engineering manuals an documentation. In most cases, the position is responsible for establishing project procedures and priorities to ensure the overall quality and timeliness. Much of the position's work involves the research and analysis of project date and specifications for which no established guidelines or conclusions are provided.

5. Which of the duties and/or specific tasks listed under 1. (above) are considered "essential functions" which must be performed by this position (with or without accommodations)? (If you need information or training on the identification of essential functions, please contact MDT Human Resources Division.)

Duty A: Geotechnical Engineering, Research and Design
Duty B: Geotechnical Project Engineering

The following mental and physical demands are associated with these essential functions:

PHYSICAL

- Lifting heavy objects (core samples, analytical equipment, etc.) up to 50 lbs.
- Ability to walk over uneven terrain or in water
- Remaining seated for extended periods of time, with occasional walking; standing; bending
- Operating a personal computer
- Communicate in writing, in person, and over the phone

MENTAL

- Ability to multi-task
- Demands for accuracy in all aspects of work
- Ability to meet inflexible deadlines
- Decision making that affects public health and safety
- Computing arithmetic operations
- Comparing data
- Compiling information
- Analyzing
- Coordinating
- Synthesizing
- Instructing

Predominant work is performed in a normal office environment and in the field, involving:

- Exposure to extreme weather
- Exposure to loud noises
- Exposure to high temperature substances

Exposure to high-speed traffic

6. Does this position supervise others? ☐ Yes ☒ No

Number directly supervised: .
Complexity level of the positions supervised .
Position Number(s) of those supervised .

7. This position is responsible for:

☐ Hiring ☐ Firing ☐ Supervision ☐ Pay Level
☐ Performance Management ☐ Promotions ☐ Discipline
☐ Other:

8. Attach an Organizational Chart.

SECTION III - Minimum Qualifications - *List minimum requirements for the first day of work.*

Knowledge and skills required for this position:

KNOWLEDGE

This position requires extensive knowledge of the concepts and theories of engineering, geology, mathematics, the physical sciences, and highway and bridge design; methods and practices of highway construction and construction engineering; engineering policy, materials properties, specifications, and test methods; and construction safety practices. The position also requires thorough knowledge of contract law and contract administration, traffic engineering; highway economic, safety, and efficiency issues; Engineering Division objectives and Materials Bureau goals; project planning; research methods and techniques; State, federal AASHTO, and FHWA requirements and standards; project specifications; Montana Materials manual, Construction Manual, Traffic Engineering Manual, Standard Specifications for Road and Bridge Construction, and a variety of other specialized engineering manuals and documentation; highway construction methods and techniques; transportation planning, design, and highway construction processes; field applications of highway engineering and construction; environmental rules and regulations; and construction methods and practices.

SKILLS

This position requires skill in reading and interpreting complex plans, specifications, and contract documents; project management; drawing conclusions and making recommendations; assessing construction plans and projects; communication and negotiation; developing and administering a variety of diverse projects and functions; and developing solutions for complex problems.

Behaviors required to perform these duties?

- **Leadership:** Provides clear directions, technical assistance, and guidance to District and Department staff, contractors, consultants, and others to ensure effective operations and project activities. Motivates subordinate staff and coworkers to achieve common objectives. Appropriately delegates responsibilities to competent staff.

- **Analytical/Interpretive Thinking:** Accurately applies new research findings, technical analyses, new methods and technologies, engineering standards, and project requirements to specific circumstances.

- **Decision Making:** Evaluates multiple factors to resolve problems. Develops technically and legally courses of action in response to complex or ambiguous geotechnical engineering issues; research conclusions and recommendations; and project management problems.

- **Achievement:** Achieves goals and brings projects to completion. Persists and stays focused when faced with a series of challenging or uncertain situations. Demonstrates a concern for working well or for competing against a standard of excellence.

- **Independence of Action:** Determines appropriate responses to geotechnical project problems and opportunities with minimal assistance or precedent.

Education:
Check the one box indicating minimum education requirements for this position for a new employee the first day of work:

☐ No education required
☐ 1-year college/voc. training
☐ AAS/2-years college/vocational training
☒ Bachelor's Degree
☐ Master's degree

Specify the acceptable bachelor's degrees: Bachelor's degree in Civil Engineering or a related engineering degree recognized as eligible for PE licensing.

Specify the related bachelor's degrees: Any recognized as eligible for PE/PG licensing

Specify other training, coursework or licensure: Certification as a Professional Engineer (P.E.) or Professional Geologist (P.G.) is required as this position reviews, approves, and signs engineering analyses on behalf of the Department.

Will a master's degree substitute for the required experience? YES If yes, specify degrees: A Master's degree in any of the above listed degree fields, in conjunction with a Bachelor's degree in one of the acceptable/related degrees, may substitute for two years of required experience.

☐ One year ☒ Two year

Will experience substitute for the degree requirement? If yes, specify experience: **None**

Experience:
Check the one box indicating minimum work-related experience requirements for this position for a new employee the first day of work:

☐ None
☐ 1 year
☐ 2 years
☐ 3 years
☐ 4 years
☒ 5 years
☐ 6 years
☐ 7 years
☐ 8 years
☐ 9 years
☐ 10 years
☐ Other _____(be specific)

For non-training assignments, five (5) years experience in civil engineering, geology, construction engineering technology, or related area. This should include a minimum of two (2) years geotechnical engineering experience related to highways, structures, slopes or similar facilities.

Certification as Professional Engineer is strongly preferred in this.

Alternative Qualifications:
This agency will accept alternative methods of obtaining necessary qualifications.

☐ Yes ☒ No

Specify:

SECTION V – Signatures

Signature indicates this statement is accurate and complete.

Employee:

Name: Title

Signature Date

Immediate Supervisor:

Name: Title

Signature Date

Division/District Administrator:

Name: Title

Signature Date

Department Designee:

Jean Bond Chief, Employee Relations Bureau
Name: Title

Signature Date

Recruitment Review: My signature below attests to my review of and determination that the minimum qualifications (education and experience) listed in this profile meet the established recruitment standards of MDT.

Human Resource Specialist (Helena/District)
Name: Title

Signature Date